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CARBON CONTENT OF VEHICLE MANUFACTURE AND TRANSPORT

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We consider the emissions from vehicle manufacturing and shipping to California from 3 locations: Michigan, China, and Germany. Upstream emissions from materials production and vehicle assembly are given in Table 1.¹ The second column is calculated assuming that light-duty vehicles travel an average of 136,000 miles over their lifetime (Delucchi, 2003).

	Emissions (gCO ₂ e/mile)	Emissions (t CO ₂ e)
U.S.	85.2	11.6
China	91.6	12.5
Germany	83	11.3

Table 1. Emissions from internal combustion engine vehicles from vehicle assembly and materials (Delucchi, 2005; Delucchi, 2003).

We also look at the emissions from transporting cars to California. Data on emissions per ton-km of freight are taken from the International Maritime Organization and shown in Table 2. Following Delucchi, 2003, we assume a light-duty vehicle weight of 1.46 metric tons. The carbon footprint from shipping is much smaller than that from manufacturing and assembly.

	Distance to Los Angeles (km)	Emissions factor (low estimate, gCO ₂ /ton- km)	Emissions factor (high estimate, gCO ₂ /ton- km)	Total emission s (low estimate, tCO ₂)	Total emission (high estimate , tCO ₂)	Median emission s (tCO ₂)
Detroit	3670	140	160	0.75	0.86	0.80
Shenzhen, China	11800	25.2	47.2	0.43	0.81	0.62
Hamburg, Germany	14800	25.2	47.2	0.54	1.02	0.78

Table 2. Emissions from transporting cars to California. Emissions factors from IMO, 2009. Port-to-port distances from SeaRates.com. Vehicle weight from Delucchi, 2003.

¹ We may be double counting some transport emissions since the data in Table 1 includes the category “vehicle assembly and transport” from Delucchi, 2005. In that paper’s lifecycle model, transport costs are a weighted average based on imports of cars into that country. Since Table 2 indicates the transportation is not very significant, this double counting is not a serious concern.

Table 3 shows the total carbon footprint from vehicle manufacture and transport to CA, obtained from combining the last columns of Tables 1 and 2. We find (surprisingly?) little difference in carbon footprint depending on where the car is manufactured. At a carbon price of \$30/tCO₂ under a cap-and-trade in California, cars produced in California would increase in cost by about \$360.

	Total emissions from vehicle manufacture and transport (tCO ₂)	% difference from U.S. case
U.S.	12.4	n.a.
China	13.1	5.6%
Germany	12.1	-2.6%

Table 3. Total carbon footprint from manufacture, assembly, and transport to California of light-duty vehicles.

Sources:

Delucchi, M.A., "A Lifecycle Emissions Model (LEM): Lifecycle Emissions from Transportation Fuels, Motor Vehicles, Transportation Modes, Electricity Use, Heating and Cooking Fuels, and Materials," Institute of Transportation Studies, UC-Davis, 2003.

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SeaRates.com, "Port to port distances," Online at:

<http://www.searates.com/reference/portdistance/>, Last accessed Nov 6, 2009.